



APPLICATION OF THE QEC (QUICK EXPOSURE CHECK) ON THE ERGONOMIC RISKS ASSESSMENT IN THE INDUSTRIAL FIELD

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ABSTRACT

One of ergonomic problems that often occur in the work place, relating to human strength and endurance while doing the job (biomechanics), is musculoskeletal or muscular strain. For the present study 5 respondents who were factory workers were selected and QEC scale was used for the assessment of the ergonomic risk factors of the respondents. These problems were often occurred by workers who did repetitive movements continuously. The observation of the activities performed by a worker, in order to identify the ergonomic risk factors, lasts between 30 and 60 minutes, this also depending on the complexity of the activity, the anthropometric data of the workers and their experience in performing these activities correctly. Therefore, the application of QEC methodology is not complicated at all, but it requires increased attention, good organization and a good understanding of ergonomic risk factors.

INTRODUCTION

The word ergonomics comes from the Greek word “ergon” which means work and “nomos” which means laws. It’s essentially the “laws of work” or “science of work”. Good ergonomic design removes incompatibilities between the work and the worker and creates the optimal work environment. The International Ergonomics Association (IEA) uses the following definition: “ergonomics is the scientific subject concerned with the interactions between people and other elements of a system and applies theories, principles, information and design methods in order to optimize human’s well-being and overall system performance” [1-2]. Ergonomic risk assessment is a process which consists of identifying situations in which workers may be subject to ergonomic risks, estimating and assessing these risks using an appropriate methodology.

It is a systematic examination of all aspects of work, in order to establish: - the causes of possible harming or injuries, - the possibilities to eliminate ergonomic risk factors and, if this is not possible, - the prevention or protection measures that are or must be implemented to control ergonomic risks. Good working system has connection with work place and operational steps of work. Work place and tools Arrangement, plus body position while working will have big impact in creating integrated working system. Through improvements, industry will run effectively and efficiently [3]. One of ergonomic problems that often occur in the work place, relating to human strength and endurance while doing the job (biomechanics), is musculoskeletal or muscular strain. These problems were often occurred by workers who did repetitive movements continuously. According to United States Public Work Statistic Bureau, accident caused by Repetitive Stress Injuries (RSI), reach more than 60% [3].

Quick Exposure Checklist (Qec)

QEC is a tool for assessing the risk of musculoskeletal disorders based mainly on the analysis of exposure to risk factors. It was developed at the Robens Center for Health Ergonomics in the UK by G. Li and P. Buckle (1998) and improved several times over the years. Over time, QEC has proven to be a valid, sensitive and reliable tool in ergonomic risk assessment. The QEC is applicable for use in a wide range of activities, is easy to use and has the advantage that workers’ activities are not interrupted during the assessment. QEC analyzes the observer’s findings and the worker’s answers in a closed set of questions, which provides a high degree of objectivity[4].

QEC is a method to assess working risk related to muscular disturbance at the workplace. This method assesses disturbance in the back, shoulder, wrist, and neck. QEC helps to prevent WMSDs, such as repetitive action, pressure force, wrong position, and work duration (Stanton, 2004). QEC examine body static and dynamic task to estimate risk level of body posture by involving movement repetition elements, energy/burden, and work length to different parts of body [3].

Objectives

The objectives of the research:

1. Collecting data from questionnaires and worker complaints
2. Calculate exposure score from questionnaires for each body part observed namely neck, shoulder, wrist, back and elbow. The risk level of injury were based on the exposure score.

Exposure to these factors causes effects on the worker (for example, overload of some muscles and joints, decreased blood flow or local muscle fatigue). If preventive measures are not

taken in time, these risk factors can generate MSDs with the worst effects.

MATERIAL AND METHODS

The study participants comprised of 5 factory workers working in textile industries. All participants were informed on the purpose of the study and completed the consent form before participating. All interviews were carried out during their working hours.

Participants

The activities of taking over some bundles of blankets which had to be taken from the machines and placed in the series. Total 5 workers who perform this activity at one of the lanes were observed and interviewed. These workers hold the position of labour. The characteristics of these workers are presented in Table 1.

Workers	Age	Height	Weight	Seniority in work
1	25	172m	70	5 years
2	37	179m	81	8 years
3	41	174m	76	5 years
4	39	169m	84	2 years
5	35	170m	69	4 years

Table 1 summarises the demographic information of 5 workers working in the textile industry.

Work schedule features: Labour

Work schedule: 8 hours/shift (break 30 min); Monday - Sunday

Brief description of the analysed activity: Workers bend over the blanket bundles to pick up pieces that weigh between 2.5Kg and 9.5 Kg

Body parts	Worker's score				
	Worker 1	Worker 2	Worker 3	Worker 4	Worker 5
Total exposure Back (static)	-	-	-	-	-
Total exposure back (movement)	30	36	32	32	32
Total exposure shoulder/Arm	26	40	32	32	32
Total exposure wrist/Hand	36	36	34	38	38
Total exposure neck	16	16	14	14	16
Total exposure driving	1	1	1	1	1
Total exposure vibration	1	1	1	1	1
Total exposure rhythm	4	9	1	1	4
Total exposure stress	4	4	4	4	4

Table 2 Results obtained by comparing the answers in the questionnaires with the QEC grids

Table 2 shows various values. For example, in terms of back position, by observation, all workers have their (back) bent, twisted and bent sideways, to a moderate extent. The answers obtained from the questionnaires will then be used to calculate the exposure value score. Example of the calculation are carried out on the QEC score sheet like shown at table 3.

The results of exposure calculation will then be calculated by using the formula:

$$E (\%) = X / x_{\max} \cdot 100 \%$$

X = The total scores obtained for the exposure to the risk of injury to the back, shoulders/arms, wrists and neck that obtained from questionnaires calculation

X_{max} = The total maximum score for exposure that may occur injury to back, shoulder/arm, wrist and neck.

X_{max} for static work is 162

X_{max} for manual handling work 176

The following calculations of QEC assessment for worker 1 = 36 + 36 + 30 + 6 + 1 + 1 + 4 + 4 = 118 X_{max} = 176

The exposure score (E) is: E = 118/176 x 100 % = 67.04

Participants	Score	Actions
Worker 1	67.61	Investigate further and change the work situation as soon as possible (1-6 months)
Worker 2	81.25	Investigate and change the work situation immediately (max. 1 month)
Worker 3	67.61	Investigate further and change the work situation as soon as possible (1-6 months)
Worker 4	69.88	Investigate further and change the work situation as soon as possible (1-6 months)
Worker 5	72.72	Investigate and change the work situation immediately (max. 1 month)

Table 4: The exposure score of the all participants

Based on the assessment of the existence work posture (working posture is not good), causing back and shoulder/arm scores high. Thus, the risk of musculoskeletal for the worker is quite dangerous if it is continued without further investigation. Based on the results of the assessment by the QEC method showed that work environment and working posture require urgent changes. Improvements that can be proposed as a solution to the problem is to reduce the maximum weight lifted manually in this work.

Performance analysis of QEC in ergonomic risk assessment
QEC identifies quickly and accurately the level of exposure of various upper body components, such as the back, shoulders, arms, wrists and neck. The results of this method lead to the implementation of effective ergonomic measures to reduce the level of exposure, as can be seen in Table 5.

*Exposure score (E)	Action
<40%	Acceptable
41-50%	Investigate further
51-70%	Investigate further and change the work situation as soon as possible (1-6 months)
>70%	Investigate and change the work situation immediately (max. 1 month)

RESULTS AND DISCUSSION

According to the results of the evaluation, the parts of the body most affected in performing the activities are: - Neck (by position) –

Hand and wrist (by position, frequency of movements and intensity of pressure) –

Back (by position, frequency and duration of movements).

And the causes of these diseases are: - workers have a high and continuous work rate,

- repeated bending movements and rotation of the trunk with weight (pieces) in the hands,

Thus, the works performed by the workers were requires investigations and immediate changes in the work situation. From the calculation of the exposure score, it can be seen that the neck score and back score classified as very high level means that the risk is very high and can cause various Musculoskeletal disorders (MSD), therefore the remedial is necessary either for the working position of the workers, or for the slowing down of the work pace and for exchanging places with other workers.

CONCLUSIONS

In conclusion, the observation of the activities performed by a worker, in order to identify the ergonomic risk factors, lasts between 30 and 60 minutes, this also depending on the complexity of the activity, the anthropometric data of the workers and their experience in performing these activities correctly. Therefore, the application of QEC methodology is not complicated at all, but it requires increased attention, good organization and a good understanding of ergonomic risk factors.

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